BEFORE THE
PUBLIC SERVICE COMMISSION OF
SOUTH CAROLINA
DOCKET NO. 2021-3-E

In the Matter of:	)	
Annual Review of Base Rates	)	**DIRECT TESTIMONY OF**
for Fuel Costs for	)	**STEVEN D. CAPPS FOR**
Duke Energy Carolinas, LLC, Increasing	)	**DUKE ENERGY CAROLINAS, LLC**
Residential and Non-Residential Rates	)	

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Steven D. Capps and my business address is 526 South Church Street, Charlotte, North Carolina.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am Senior Vice President of Nuclear Operations for Duke Energy Corporation ("Duke Energy") with direct executive accountability for Duke Energy's South Carolina nuclear plants, including Duke Energy Carolinas, LLC's ("DEC" or the "Company") Catawba Nuclear Station ("Catawba") in York County, South Carolina, the Oconee Nuclear Station ("Oconee") in Oconee County, South Carolina, and Duke Energy Progress, LLC's Robinson Nuclear Plant, located in Darlington County, South Carolina.

Q. WHAT ARE YOUR RESPONSIBILITIES AS SENIOR VICE PRESIDENT OF NUCLEAR OPERATIONS?

A. As Senior Vice President of Nuclear Operations, I am responsible for providing executive oversight for the safe and reliable operation of Duke Energy's three South Carolina operating nuclear stations. I am also involved in the operations of Duke Energy's other nuclear stations, including DEC's McGuire Nuclear Station ("McGuire") located in Mecklenburg County, North Carolina

Q. PLEASE SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I have more than 34 years of experience in the nuclear field. I joined Duke Energy in 1987 as a field engineer at Oconee. During my time at Oconee, I served in a variety of leadership positions at the station, including Senior Reactor Operator, Shift Technical Advisor, and Mechanical and Civil Engineering Manager. In 2008, I transitioned to McGuire as the

Engineering Manager. I later became plant manager and was named Vice President of McGuire in 2012. In December 2017, I was named Senior Vice President of Nuclear Corporate for Duke Energy with direct executive accountability for Duke Energy's nuclear corporate functions, including nuclear corporate engineering, nuclear major projects, corporate governance and operation support and organizational effectiveness. I assumed my current role in October 2018. I earned a B.S. in Mechanical Engineering from Clemson University and I have completed the Institute of Nuclear Power Operations (INPO) senior nuclear plant management course.

Q. HAVE YOU TESTIFIED OR SUBMITTED TESTIMONY BEFORE THIS COMMISSION IN ANY PRIOR PROCEEDINGS?

A. Yes. I testified before the Public Service Commission of South Carolina (the "Commission") in DEC's 2018, 2019, and 2020 fuel cost proceedings in Docket No. 2018-3-E, Docket No. 2019-3-E, and Docket No. 2020-3-E.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to describe and discuss the performance of DEC's nuclear fleet during the period of June 1, 2020 through May 31, 2021 (the "review period").

Q. YOUR TESTIMONY INCLUDES THREE EXHIBITS. WERE THESE EXHIBITS PREPARED BY YOU OR AT YOUR DIRECTION AND UNDER YOUR SUPERVISION?

A. Yes. These exhibits were prepared at my direction and under my supervision.

Q. PLEASE PROVIDE A DESCRIPTION OF THE EXHIBITS.

A. The exhibits and descriptions are as follows:

Capps Exhibit 1 - Calculation of the nuclear capacity factor for the review period pursuant to S.C. Code § 58-27-865

Capps Exhibit 2 - Nuclear outage data for the review period

Capps Exhibit 3 - Nuclear outage data through the billing period [1]

Q. PLEASE DESCRIBE DEC'S NUCLEAR GENERATION PORTFOLIO.

A. The Company's nuclear generation portfolio consists of approximately 5,389[2] megawatts ("MWs") of generating capacity, made up as follows:

Oconee - 2,554 MWs

McGuire - 2,316 MWs

Catawba - 519 MWs[3]

Q. PLEASE PROVIDE A GENERAL DESCRIPTION OF DEC'S NUCLEAR GENERATION ASSETS.

A. DEC's nuclear fleet consists of three generating stations and a total of seven units. Oconee began commercial operation in 1973 and was the first nuclear station designed, built, and operated by DEC. It has the distinction of being the second nuclear station in the country to have its license, originally issued for 40 years, renewed for up to an additional 20 years by the Nuclear Regulatory Commission ("NRC"). The license renewal, which was obtained in 2000, extends operations to 2033, 2033, and 2034 for Oconee Units 1, 2, and 3 respectively.

[1] This data is provided in confidential and publicly redacted versions for security purposes.
[2] Based on Net Maximum Dependable Capacity as of January 1, 2021.
[3] Reflects DEC's 19.2 percent ownership of the Catawba Nuclear Station.

McGuire began commercial operation in 1981 and Catawba began commercial operation in 1985. In 2003, the NRC renewed the licenses for McGuire and Catawba for up to an additional 20 years each. This renewal extends operations until 2041 for McGuire Unit 1, and 2043 for McGuire Unit 2 and Catawba Units 1 and 2. The Company jointly owns Catawba with North Carolina Municipal Power Agency Number One, North Carolina Electric Membership Corporation, and Piedmont Municipal Power Agency.

In June 2021, the Company submitted a subsequent license renewal ("SLR") application to the NRC for the three Oconee units. If the license renewal is granted by the NRC, the Company would be authorized to operate the Oconee reactors for an additional 20-year period. As announced previously, Duke Energy intends to seek SLR for the other eight nuclear units.

Q. WHAT ARE DEC'S OBJECTIVES IN THE OPERATION OF ITS NUCLEAR GENERATION ASSETS?

A. The primary objective of DEC's nuclear generation department is to safely provide reliable and cost-effective electricity to DEC's Carolinas customers. The Company achieves this objective by focusing on a number of key areas. Operations personnel and other station employees are well-trained and execute their responsibilities to the highest standards in accordance with detailed procedures. The Company maintains station equipment and systems reliably and ensures timely implementation of work plans and projects that enhance the performance of systems, equipment, and personnel. Station refueling and maintenance outages are conducted through the execution of well-planned, well-executed, and high-quality work activities, which effectively ready the plant for operation until the next planned outage.

Q. PLEASE DISCUSS THE PERFORMANCE OF DEC'S NUCLEAR FLEET DURING THE REVIEW PERIOD.

A. The Company operated its nuclear stations in a reasonable and prudent manner during the review period, providing approximately 62 percent of the total energy generated by DEC. The seven nuclear units operated at an actual system average capacity factor of 96.96% percent for the review period which included three refueling outages.

As shown on Capps Exhibit 1, DEC achieved a net nuclear capacity factor, excluding reasonable outage time, of 101.73 percent for the review period. This capacity factor is above the 92.5 percent set forth in S.C. Code § 58-27-865(F), which states in pertinent part:

> There shall be a rebuttable presumption that an electrical utility made every reasonable effort to minimize cost associated with the operation of its nuclear generation facility or system, as applicable, if the utility achieved a net capacity factor of ninety-two and one-half percent or higher during the period under review. The calculation of the net capacity factor shall exclude reasonable outage time associated with reasonable refueling, reasonable maintenance, reasonable repair, and reasonable equipment replacement outages; the reasonable reduced power generation experienced by nuclear units as they approach a refueling outage; the reasonable reduced power generation experienced by nuclear units associated with bringing a unit back to full power after an outage....

The performance results discussed above support DEC's continued commitment for achieving high performance without compromising safety and reliability.

Q. HOW DOES DEC'S NUCLEAR FLEET COMPARE TO INDUSTRY AVERAGES?

A. Industry benchmarking efforts are a principal technique used by the Company to ensure best practices. Duke Energy's nuclear fleet continues to rank among the top performers when compared to other large domestic nuclear fleets using Key Performance Indicators in the areas of personal safety, radiological dose, manual and automatic shutdowns,

capacity factor, forced loss rate, industry performance index, and total operating cost. On a larger industry basis using 2020 data from the Electric Utility Cost Group, all three of DEC's nuclear plants rank in the top quartile in total operating cost per MWH among the 56 U.S. operating nuclear plants. By continually assessing the Company's performance as compared with industry benchmarks, the Company continues to ensure the overall safety, reliability and cost-effectiveness of DEC's nuclear units.

Additionally, for 21 consecutive years DEC's nuclear plants have surpassed a 90 percent annual capacity factor threshold. As a result of this strong operational performance, the Company has produced approximately 47.1 million MWHs of additional generation, which is equivalent to an additional 9.8 months of output (based on DEC's average annual generation for the same 21-year period). These performance results support DEC's continued commitment to achieving high performance without compromising safety and reliability.

Q. WHAT IMPACTS A UNIT'S AVAILABILITY AND WHAT IS DEC'S PHILOSOPHY FOR SCHEDULING REFUELING AND MAINTENANCE OUTAGES?

A. In general, refueling requirements, maintenance requirements, prudent maintenance practices, and NRC operating requirements impact the availability of DEC's nuclear system. Prior to a planned outage, DEC develops a detailed schedule for the outage and for major tasks to be performed including sub-schedules for particular activities.

The Company's scheduling philosophy is to plan for a best possible outcome for each outage activity within the outage plan. For example, if the "best ever" time an outage task was performed is 10 days, then 10 days or less becomes the goal for that task in each

subsequent outage. Those individual goals are incorporated into an overall outage schedule. The Company aggressively works to meet, and measures itself against, that schedule. Further, to minimize potential impacts to outage schedules, "discovery activities" (walk-downs, inspections, etc.) are scheduled at the earliest opportunity so that any maintenance or repairs identified through those activities can be promptly incorporated into the outage plan.

As noted, the schedule is utilized for measuring outage planning and execution and driving continuous improvement. However, in order to provide reasonable, rather than best ever, total outage time for planning purposes, particularly with the dispatch and system operating center functions, DEC also develops an allocation of outage time which incorporates unforeseen schedule delays that may be needed for unplanned equipment repairs found during inspections. The development of each outage allocation is dependent on maintenance and repair activities included in the outage, as well as major projects to be implemented during the outage. Both schedule and allocation are set aggressively to drive continuous improvement in outage planning and execution.

Q. HOW DOES DEC HANDLE OUTAGE EXTENSIONS AND FORCED OUTAGES?

A. When an outage extension becomes necessary, DEC expects that work completed in the extension results in longer continuous run times and fewer forced outages, thereby reducing overall fuel costs in the long run. Therefore, if an unanticipated issue that has the potential to become an on-line reliability issue is discovered while a unit is off-line for a scheduled outage and repair cannot be completed within the planned work window, the outage may be extended for the minimum time needed to perform necessary maintenance or repairs prior to returning the unit to service. In the event that a unit is forced off-line, every effort

is made to perform the repair and return the unit to service as quickly as possible. DEC assesses potential causes of each forced outage or extended outage and implements best practices moving forward. The nuclear industry recognizes that constant focus on operational excellence results in improved nuclear safety and reliability.

Q. WHAT OUTAGES WERE REQUIRED FOR REFUELING AT DEC'S NUCLEAR FACILITIES DURING THE REVIEW PERIOD?

A. There were three refueling outages during the review period; fall 2020 outages at McGuire Unit 1 and Oconee Unit 1, followed by a spring 2021 outage at Catawba Unit 2.

McGuire Unit 1 was removed from the grid on September 19, 2020 to begin refueling. Along with routine refueling activities, safety and reliability enhancements and inspections were completed. Reliability enhancements completed during the refueling outage included replacement of the 1A reactor coolant pump seal and the 1B1 component cooling pump motor. Valve work and modifications completed included valve and valve actuator replacements in the heater drain, safety injection, nuclear service water and station air systems. Inspections completed included the reactor vessel 10-year in-service inspection, material reliability program upper and lower internals inspection, and inspection of the reactor coolant hot and cold leg nozzles. An 8-year reactor coolant pump switchgear inspection and testing of the 1A engineered safety features was also completed. The unit's turbine driven auxiliary feed pump turbine and 1C low pressure turbine were also inspected. With the exception of duration, all outage goals were met. The outage extended four days beyond the scheduled allocation due to challenges with reactor vessel inspection equipment performance and an emergent repair on a cold leg accumulator outlet check valve. Once work activities, testing and inspections were completed, the unit

returned to service on October 21, 2020. The total outage duration was 32.1 days compared to a 28-day scheduled allocation.

On October 16, 2020 Oconee Unit 1 shut down for refueling. In addition to refueling, safety and reliability enhancements, testing and inspections were completed. Significant outage scope included the replacement of the unit's low-pressure turbine rotors, completing a multi-year project to replace the aging low-pressure turbines on all three Oconee units. The replacement of the low-pressure turbine rotors improves reliability and reduces maintenance expense and inspection requirements during future refueling outages. Other reliability enhancements included replacement of the 1B1 reactor coolant pump motor, 1A1 and 1B2 reactor coolant pump seals, 1D2 heater drain pump and 1A high pressure injection pump motor. Replacement of the unit 1 standby shutdown facility reactor coolant letdown line also completed a multi-year station project, and this work has now completed on all three Oconee units. Electrical work completed included main power relaying upgrade and preventive maintenance on the Unit 1 main transformer and various switchgear and breakers. Inspection activities included steam generator Eddy Current and reactor vessel materials reliability program inspections. After refueling, maintenance, inspections and testing completed, the unit returned to service on November 18, 2020, for a total duration of 32.2 days compared to a 33-day scheduled allocation.

The third and final refueling outage executed during the review period began on March 27, 2021 when Catawba Unit 2 was removed from service for refueling. Safety and reliability enhancements, testing and inspections were also completed during the outage while the unit was refueled. Major outage scope included the replacement of the unit's low-pressure turbines. The new low-pressure turbines improve reliability and reduce

future inspection and maintenance costs. The replaced turbines date back to the unit's original construction. Other significant safety and reliability enhancements completed during the outage included core exit thermocouple and cabling replacements, and retubing of the 2A component cooling heat exchanger. Large pump and motor maintenance included the replacement of the 2C reactor coolant pump seal, and refurbishment of the 2A chemical injection pump seals and motor. Inspections and testing completed included a containment integrated leak rate test, primary side steam generator Eddy Current test, and volumetric reactor head inspection. The volumetric reactor head inspection identified a flaw that necessitated an emergent repair to the reactor head involving a weld overlay for core exit thermocouple nozzle 74. The outage was completed on May 3, 2021, 5 days beyond the scheduled allocation. The primary driver of the outage extension was the emergent thermocouple nozzle repair.

Q. OTHER THAN REFUELING, WHAT OUTAGES OCCURRED AT DEC'S NUCLEAR FACILITIES DURING THE REVIEW PERIOD?

A. On September 8, 2020, Catawba Unit 1 experienced an automatic reactor trip during testing activities when a technician incorrectly removed a drawer within the Nuclear Instrumentation System that was adjacent to the drawer being worked on. Plant personnel responded safely and efficiently and returned the unit to service in just over 20 hours. McGuire Unit 2 entered a forced maintenance outage on February 21, 2021 when equipment failures allowed water to contaminate turbine lube oil. Plant personnel proactively shut the unit down to protect the main turbine. Repairs were completed and the unit returned to service on February 24, 2021; a duration of 3 days.

Q. WHAT IS YOUR VIEW OF THE COMPANY'S NUCLEAR PLANT PERFORMANCE DURING THE REVIEW PERIOD?

A. Based on my oversight and review of operations during the review period, the Company's nuclear units were operated reasonably and prudently, and our operations were conducted in a way that minimized our fuel costs. The successful completion of three refueling outages and the achievement of a 96.96 percent capacity factor during the review period, validates the Company's performance.

Q. DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?

A. Yes, it does.

DUKE ENERGY CAROLINAS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR CAPACITY FACTOR PURSUANT TO S.C. CODE ANN. § 58-27-865(F)
REVIEW PERIOD OF JUNE 2020 THROUGH MAY 2021

1	Nuclear System Actual Net Generation During Review Period	60,982,098	MWH
2	Total Number of Hours during Review Period	8,760	
3	Nuclear System MDC during Review Period	7,180	MW
4	Reasonable Nuclear System Reductions	2,949,549	MWH
5	Nuclear System Capacity Factor L1/((L2*L3)-L4)*100	101.73	%

DUKE ENERGY CAROLINAS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR OUTAGE DATA FOR REVIEW PERIOD OF
June 2020 THROUGH MAY 2021

Nuclear outages during the Review Period

Station/Unit	Date of Outage	Reason for Outage
Catawba 1	9/8/2020 - 9/9/2020	Forced outage
McGuire 1	9/19/2020 - 10/21/2020	Scheduled refueling outage
Oconee 1	10/16/2020 - 11/18/2020	Scheduled refueling outage
McGuire 2	2/21/2021 - 2/24/2021	Forced outage
Catawba 2	3/27/2021 - 5/3/2021	Scheduled refueling outage

DUKE ENERGY CAROLINAS, LLC
SOUTH CAROLINA ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS
NUCLEAR OUTAGE SCHEDULE THROUGH BILLING PERIOD

Scheduled nuclear outages lasting one week or more through the Billing Period

Station/Unit	Date of Outage[1]	Reason for Outage

REDACTED

[1] This exhibit represents DEC's current plan, which is subject to change based on fluctuations in operational and maintenance requirements.